

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Confirmation No.: 9022

Kaoru FUKUDA et al.

Art Unit: 1795

Serial No.: 10/532,963

Examiner: Edu E. Enin-Okut

Filed: April 27, 2005

Docket No.: 108421-00117

For: ELECTRODE STRUCTURE FOR SOLID POLYMER TYPE FUEL CELL

**RESPONSE UNDER 37 C.F.R. §1.116**

**Mail Stop AF**

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

**May 6, 2009**

Sir:

In response to the Office Action dated January 7, 2009, consideration of the following remarks is respectfully requested. The period for response is extended one months, from April 7, 2009, to May 7, 2009, with payment of the appropriate fees submitted herewith via EFS.

**Remarks** begin on page 2.

**Conclusion** begins on page 9.

**REMARKS**

The Office Action dated January 7, 2009 has been received and carefully noted. The following remarks are being submitted as a full and complete response thereto.

Claims 1-6 have been rejected and are pending in this application. Applicants submit that no new matter is added. Applicants respectfully request reconsideration and withdrawal of all rejections.

**Summary of the Office Action**

In the outstanding Office Action dated January 7, 2009, claims 1 and 4 were rejected under 35 U.S.C. § 103(a) as being unpatenable over U.S. Patent 6,821,661 to Haridoss et al. (hereinafter, "Haridoss") in view of U.S. Patent Application Publication 2002/0064699 to Fukuda et al. (hereinafter, "Fukuda") and U.S. Patent Application Publication 2002/0068213 to Kaiser et al. (hereinafter, "Kaiser"). Claim 2 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Haridoss, Fukuda and Kaiser further in view of U.S. Patent No. 6,280,871 to Tosco et al. (hereinafter, "Tosco") and U.S. Patent No. 6,083,638 to Taniguchi et al. (hereinafter, "Taniguchi"). Claim 3 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Haridoss, Fukuda and Kaiser further in view of Tosco. Claims 5 and 6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Haridoss, Fukuda, Kaiser, Japan Patent Application Publication No. 10-223233 to Saito (hereinafter, "Saito") and U.S.

Patent Application Publication No. 2003/0072991 to Matsubara et al. (hereinafter, "Matsubara").

### **Summary Response to the Office Action**

All claims have been left in their original or previously presented form. Thus, claims 1-6 are currently pending in the application and subject to examination. The Applicants hereby traverse the rejection, as follows.

### **Rejection Under 35 U.S.C. §103**

In the outstanding Office Action, independent claim 1 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Haridoss in view of Fukuda and Kaiser. The Applicants respectfully traverse the rejection, because Haridoss, Fukuda and Kaiser, either independently or in combination, fail to teach each and every feature of independent claim 1. For example, independent claim 1 recites, amongst other features, "an anode and a cathode each having a catalytic layer and a diffusion layer" (emphasis added) and "wherein a differential pressure of the anode diffusion layer measured by the differential pressure measuring method is in a range of 60 to 120 mmAq" and where the anode diffusion layer further comprises "a carbon-based material" with "a water holding layer thereon containing water holding material for 5 to 20 wt% of total weight of an electron conductive material and the water holding material, or carbon particles having water absorption amount at saturated water vapor pressure at 60°C of not less than 150 cc/g," and "wherein water absorption ratio of the anode diffusion layer at

60°C is in a range of 40 to 85%, and wherein a ratio of quantity of electric charge of catalytic material of the cathode catalytic layer existing a proton conductive passage from the polymer electrolyte membrane measured by a cyclic voltammetric method is not less than 15% of the quantity of electric charge of all the catalytic material existing in the cathode.” The Applicants respectfully submit that Haridoss, Fukuda and Kaiser, either independently or in combination, fail to teach or suggest at least an anode diffusion layer as claimed in claim 1, much less the very specific features of that diffusion layer claimed in detail in claim 1.

The Examiner admits that Haridoss **does not teach** a water holding layer on the carbon layer with the specifications claimed in claim 1. The Examiner attempts to make up for this deficiency of Haridoss by replacing the “carbon fibers,” “carbon paper or cloth” in the GDL of Haridoss by catalyst carrying carbon black particles of taught in Fukuda. In order to justify this combination of Haridoss and Fukuda, the Examiner states that Fukuda teaches the carbon black particles “in a fuel electrode of a solid polymer fuel cell” and that “it would be obvious” to “use the water holding material of Fukuda” (i.e., the catalyst carrying carbon black particles) “in the water holding layer of Haridoss to ensure the proton conductivity of the electrolyte membrane by maintaining it in a wet state.”

The Applicants respectfully disagree and submit that, even if this alleged combination were proper, it would not provide the claimed features of claim 1. The Applicants respectfully submit that the catalyst coated carbon black particles of Fukuda would not provide at least the claimed water absorption properties or the claimed feature of “a differential pressure of the anode diffusion layer

measured by the differential pressure measuring method is in a range of 60 to 120 mmAq.”

The Examiner argues on page 4 of the Office Action that the claimed water absorption ratio of the anode diffusion layer would be obtained if the carbon particles disclosed in Fukuda et al. are used in the device of Haridoss. However, this appears to be based on an erroneous reading of the instant specification. The Examiner cites paragraph 11 of the instant specification in alleged support of the proposition that any diffusion layer containing carbon particles having a water absorption amount at saturated water vapor pressure of 60 °C of not less than 150 cc/g would automatically exhibit the claimed water absorption ratio. However, as is disclosed in Comparative Examples 22 and 31 in the present invention, merely using the carbon particles having water absorption amount of not less than 150 cc/g will not necessarily yield a water absorption ratio of the anode diffusion layer in the range of from 40 to 85%. In the present invention, the water absorption ratio is set in the range of from 40 to 85% by adding the required amount of such carbon particles. Therefore, the Examiner's use of the instant specification and the conclusions drawn from that use are in error.

The Examiner seems to implicitly admit that the alleged combination of Haridoss and Fukuda does not provide at least the claimed differential pressure measurement on page 4 of the Office Action. For this claimed feature the Examiner relies on Haridoss by alleging that “Haridoss also teaches the polymer electrolyte fuel cell has an anode differential pressure less than 1 psig (4:61-63).”

In fact the above quote from Haridoss actually refers to the polymer electrolyte fuel cell disclosed in the specification of Haridoss, not the polymer electrolyte fuel cell as allegedly modified by the Examiner. That is, the Examiner modifies the device of Haridoss and then relies upon a measurement pertaining to the device prior to the modification. This is improper.

Even without consideration of the modification, this comparison of the differential pressure measurement of Haridoss with the claimed differential pressure measurement is erroneous. In fact, the claimed measurement concerns an anode diffusion layer that includes a “carbon based material” with a “water holding layer” thereon. In Haridoss, in contrast, the differential pressure measurement concerns an aggregate of carbon-based material, a water holding layer, and a catalytic layer. That is, the differential pressure of Haridoss includes the catalytic layer which is **not** included in the claimed differential pressure measurement of claim 1. Claim 1, instead, refers to “a differential pressure **of the anode diffusion layer** measured by the differential pressure measuring method [to be] in a range of 60 to 120 mmAq” (emphasis added). Therefore, even if the alleged modification of the Gas Diffusion Layer of Haridoss by the Examiner were not to change the gas permeability of that layer, the differential pressure measurements of Haridoss and the instant invention would still not be comparable and the combination of Haridoss and Fukuda would not provide at least this claimed feature of the invention.

The present invention can include a water holding layer arranged in the anode diffusion layer. This can allow water held in the water holding layer to be

electrolyzed during a fuel shortage in lieu of corrosion of the catalyst supporting carbon. Water from the fuel gas or generated in the cathode electrode (which can migrate to the anode electrode by diffusion), is temporarily held in the water holding layer. That is, when there is sufficient fuel gas, the water holding layer holds the water from the fuel gas and/or from the cathode. On the other hand, when there is a shortage of fuel, the water held in the water holding layer can be supplied to the anode catalyst layer. Then the water can be electrolyzed to produce protons in the anode catalyst layer which are then supplied to the cathode electrode. Since the water is electrolyzed continuously, carbon corrosion reaction due to fuel shortage can be prevented.

No cited reference, nor any alleged combination of references, discloses the differential pressure of the anode diffusion layer (consisting of gas diffusion layer and water holding layer, not containing catalyst layer) and the water absorption ratio of the anode diffusion layer. Further, no cited reference, nor any alleged combination of references, discloses or suggests that water is temporarily kept in the gas diffusion layer and is supplied to the anode catalyst layer when there is a shortage of fuel to prevent the catalyst supporting carbon from being corroded. Instead, both Haridoss et al. (column 5, lines 12 to 23) and Fukuda et al.. (paragraph 0030) merely aim to moisturize the membrane.

The Applicants also respectfully submit that Kaiser, as cited by the Examiner, does not cure the deficiencies of the combination of Haridoss and Fukuda with respect to the anode diffusion layer as claimed in claim 1.

For at least these reasons, Haridoss, Fukuda, and Kaiser either independently or in combination, do not teach or suggest all of the features of independent claim 1 and the similar features of amended independent claims 4 and 5. Moreover, Applicants also respectfully assert that dependent claims 2, 3 and 6 are allowable at least because of their ultimate dependency on independent claims 1 and 5 and for the additional features that they recite. Accordingly, the Applicants respectfully request that the 35 U.S.C. § 103(a) rejections of the Office Action of January 7, 2009 relating to these claims be withdrawn.

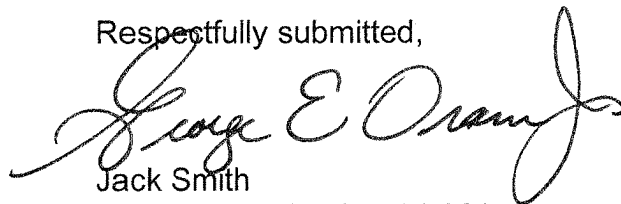


**CONCLUSION**

Applicants respectfully submit that this application is in condition for allowance and such action is earnestly solicited. If the Examiner believes that anything further is desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned representative at the telephone number listed below to schedule a personal or telephone interview to discuss any remaining issues.

In the event that this paper is not being timely filed, Applicants respectfully petition for an appropriate extension of time. Any fees for such an extension, together with any additional fees that may be due with respect to this paper, may be charged to Counsel's Deposit Account Number 01-2300, referencing Docket Number 108421-00117.

Respectfully submitted,



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